

# Chemical Segregation for HHW

P  
R  
M



**3 – Flammable / combustible**

can crush – a-fuel  
shred – stab

and **CAKE**



L  
A  
B



**6 - Poison**



**8 - Corrosive**

8A  
8B



**5.1 - Oxidizer**



**5.2 - Organic Peroxide**

P  
A  
C  
K



**4.1 - Flammable Solid**



**4.2 - Spontaneously Combustible**

O  
T  
H  
E  
R



**1 - Explosive**



**2 - Compressed Gas**



**7 - Radioactive**



**9 - Miscellaneous**



**4.3- Dangerous When Wet**

**Two** types of reactions result from the formation and breakdown of chemical bonds:



- **Exothermic** – total energy absorbed is less than total energy released – resulting in extra energy released, usually in the form of **heat**!

These reactions generally don't need an external heat source. Remember the kiln dust and water!

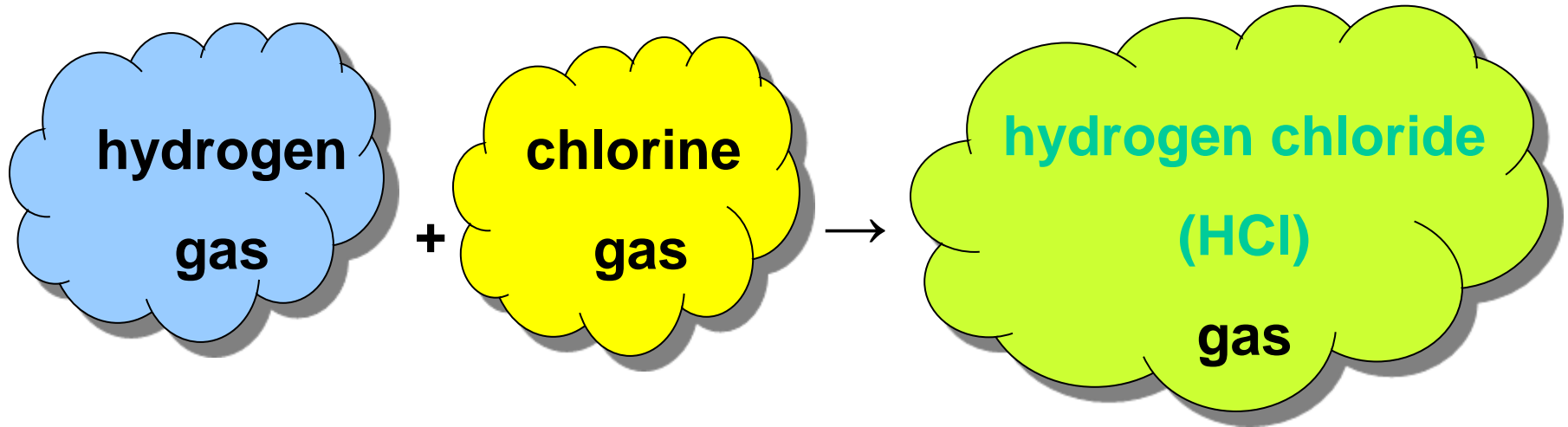


➤ **Endothermic Reactions** – require an external energy source (heat). More energy is consumed than released.  
Most take place in controlled situations like laboratories.

Endothermic reactions we are more familiar with include:  
Propane tank icing over while filling or discharging. The liquid propane changing to its gaseous form draws energy (heat) from the surrounding moisture in the air – water vapor freezes!

Instant Ice packs – how do they work?

Nitrates + water = COLD water.      What's in the ice pack?



# Organic vs. Inorganic

- **Organic chemistry** (or Carbon Chemistry) is based on carbon bonded to hydrogen, nitrogen or carbon. Covalent bonds (share electrons) are relatively weak bonds. Life forms on this planet are carbon based.
- **Inorganic chemistry** (or Mineral Chemistry) is based on non-hydrocarbon ionic bonds (donate electrons), stronger than covalent bonds.

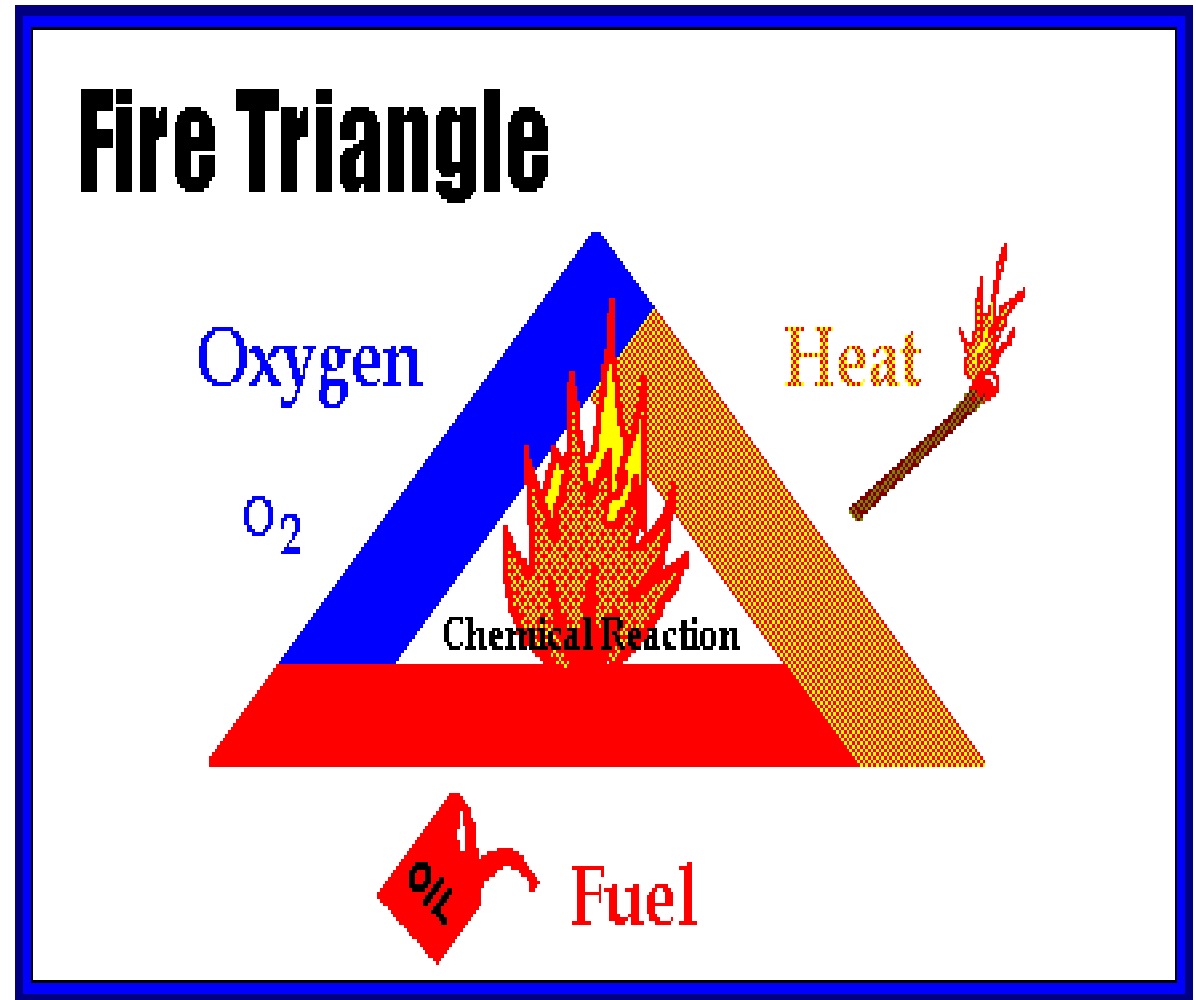


**Flammable/combustible hydrocarbons** SG < 1.0  
gasoline and motor oil will float.

**Chlorinated/Halogenated hydrocarbons** SG > 1.0  
freon or methylene chloride will sink.

**Antifreeze, acids and alkalines** are also heavier than water even though they are miscible, which means higher concentration may accumulate at the bottom of a container

- LEL/LFL
- UEL/UFL
- Flashpoint
- Autoignition
- Flammable
- Combustible



- **LEL/LFL – Lower Explosive Limit/ Lower Flammable Limit:** the lowest concentration of a combustible gas or vapor that will explode, ignite or burn in the presence of an ignition source.
- **UEL/UFL – Upper Explosive Limit/Upper Flammable Limit:** the highest concentration of a combustible gas or vapor that will ignite in the presence of an ignition source.

**NOTE:** Combustion will not occur below the **LEL** or above the **UEL**





- **Autoignition:** the lowest temperature at which a material will spontaneously ignite in a normal atmosphere without an external source of ignition.

The autoignition temperature of:

Triethylborane - 4 F

White Phosphorus 93 F

Paper 451 F – think “Fahrenheit 451” by Ray Bradbury.

Gasoline 495 F

- **Flashpoint:** the minimum temperature at which a flammable liquid will continue to evolve ignitable vapors at it's surface.

**DOT Flammable liquid – flashpoint  $\leq 140$  F.**

**DOT Combustible liquid – flashpoint  $\geq 141$  F and  $\leq 200$  F**

## Hydrocarbons = hydrogen (H) + carbon (C)

Three main groups:

- **Flammable/Combustible** – gasoline, motor oil, MEK. Good fuel source, ignitable, specific density  $< 1$ , immiscible with water
- **Chlorinated/Halogenated** – freon, perchloroethylene, PCBs, fluorobromomethane. Not good fuels, non-flammable, solvents, specific density  $> 1$ , immiscible with water.
- **Alcohol** – 2-butoxyethanol, methanol, rubbing alcohol. Fuel source, good solvents, miscible with water (and acid/alkaline)

Addition of Chlorine, Bromine and Fluorine to hydrocarbon base detracts from the compound's ability to act as a fuel.

**Corrosive material** – a liquid or solid that causes visible destruction or irreversible alteration to human skin tissue at the site of contact, or a liquid that has severe corrosion rate on steel or aluminum under certain criteria.

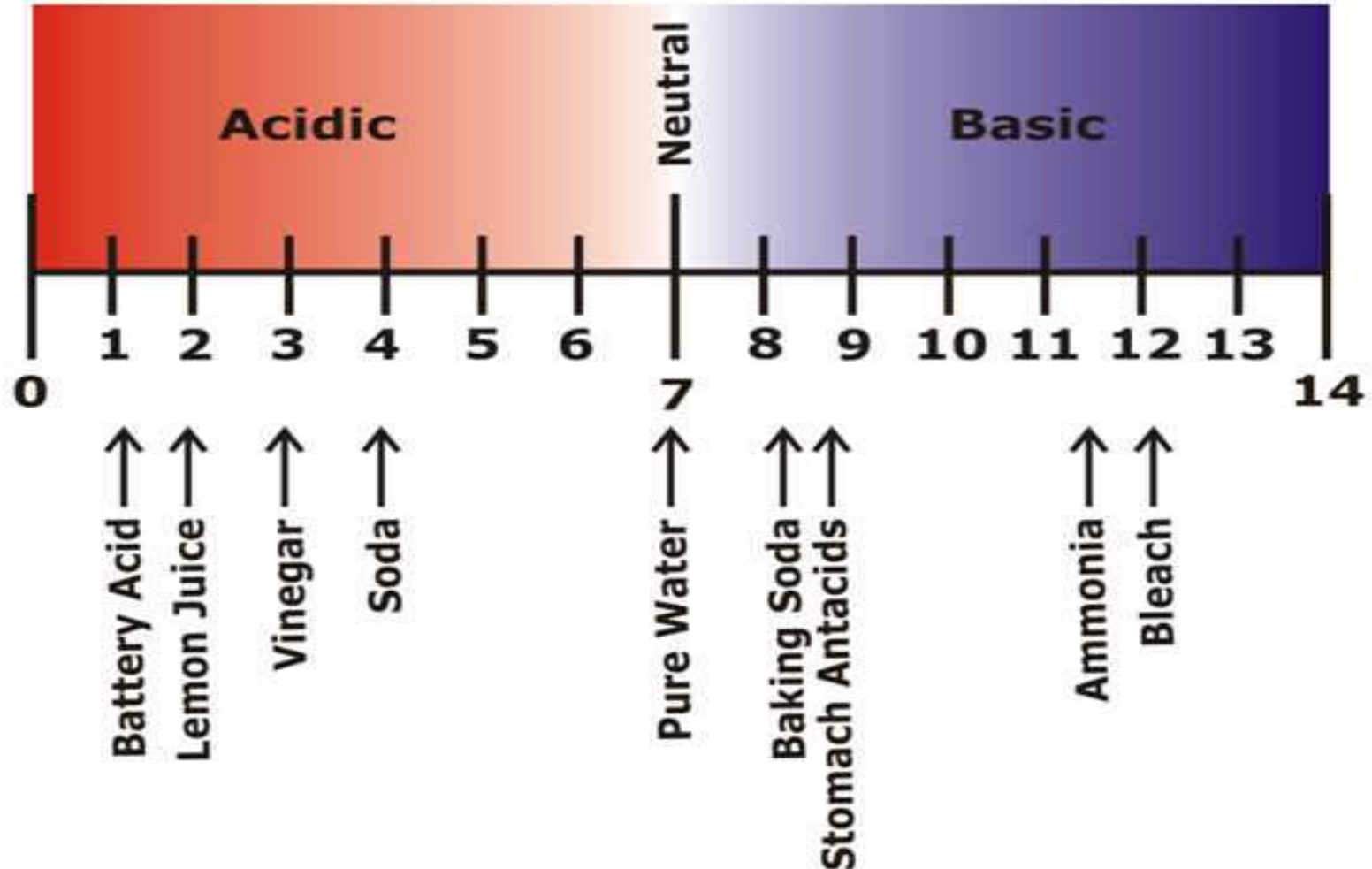


The whole concept of pH is based on the fact that at any given time, some portion of pure water exists as its components, an **hydrogen (H) ion** and an **hydroxide (OH) ion**, in equal amounts, making a “neutral” solution

pH stands for “potential hydrogen”

pH is the % of **Hydrogen (acid)** or **Hydroxide (alkaline)** ions that are released when a chemical compound comes in contact with **WATER**.

## The pH Scale



**Old Drano - worked really well  
because in addition to corrosive  
alkaline it contained aluminum chips!**



- A Chemist considers compounds with a pH < 7.0 to be acid, a pH > 7.0 to be alkaline/base (basic) and a pH of 7.0 is neutral.
  - Chemical compounds may have acid in their name (i.e. salicylic acid) but not have a pH we would consider acidic for packaging.
- The DOT (packaging/label/transport) defines **corrosivity** as follows:  
**pH ≤ 2.0 as corrosive acid; pH ≥ 12.5 as corrosive alkaline.**
- HHW/Field Chemists generally package material as follows:  
**pH ≤ 4.0 as ACID**  
**pH ≥ 10.0 as ALKALINE**

The pH scale is logarithmic like the Richter scale for earthquakes. Material with pH of 6.0 is 10x more acidic than neutral; pH of 5 is 100x more acidic and pH of 4.0 is 1000x more acidic.

NOTE: The term corrosive can apply to both, acid or alkaline, however, **caustic** applies to **corrosive alkaline** only.

- Oxidizers are compounds which are capable of reacting, with and oxidizing, other materials.
- An example of oxidation is the process we know as corrosion, where metal reacts with air to form metal oxides – rust.
- The primary industry hazard with this class of compounds lies in their ability to act as an oxygen source and stimulate the combustion of organic materials.







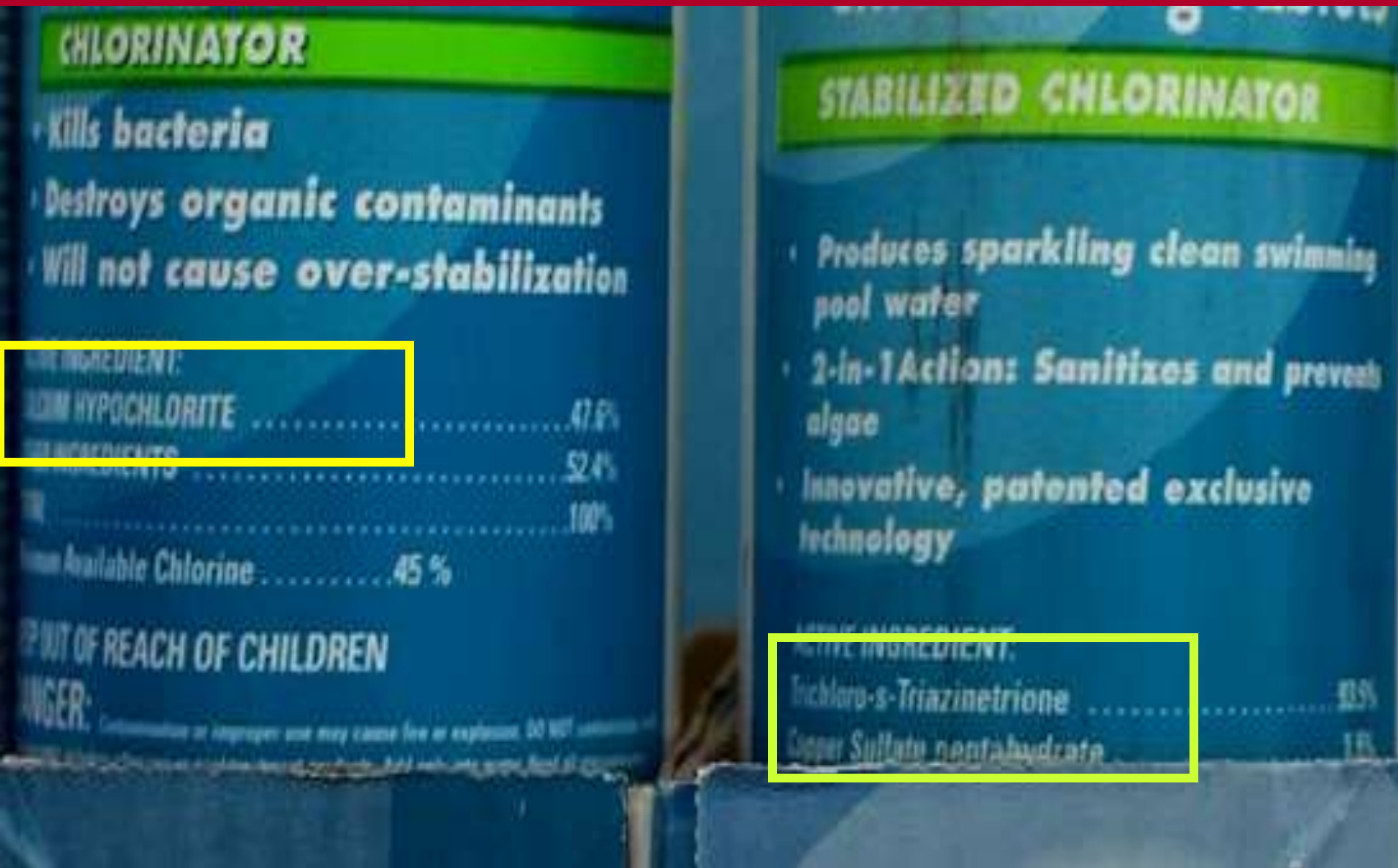
In areas where burning is allowed, light a fire on top of the stump with charcoal briquettes. The heat created will be carried throughout the stump. The stump should smolder down to the roots until only ashes remain. Do not burn stump if it is next to any structure.

**CAUTION:** Keep out of reach of children. Harmful if swallowed. This product contains potassium nitrate. If swallowed call a physician. If in eyes or on skin wash with clean water.

**NOTICE:** Seller makes no warranty, expressed or implied, concerning the use of this product other than indicated in the label. Buyer assumes all risk of use/or handling of this material when such use/or handling is contrary to label instructions.







## Classification System for Oxidizing Materials

Class Rating	Hazard Description
Class 1	An oxidizing material whose primary hazard is that it may increase the burning rate of combustible material with which it comes in contact.
Class 2	An oxidizing material that will moderately increase the burning rate or which may cause spontaneous ignition of combustible material with which it comes in contact.
Class 3	An oxidizing material that will cause a severe increase in the burning rate of combustible material with which it comes in contact or which will undergo vigorous self-sustained decomposition when catalyzed or exposed to heat.
Class 4	An oxidizing material that can undergo an <b>explosive reaction when</b> catalyzed or exposed to heat, shock or friction.

**Class 1 –**

Barium chlorate  
Potassium nitrate  
Nitric acid <70%  
Sodium perborate

**Class 2 –**

Calcium hypochlorite  
Potassium permanganate  
Hydrogen peroxide (27-52%)  
Nitric acid >70%

**Class 3 –**

Potassium chlorate  
Sodium dichloro-s-triazinetriene  
Perchloric acid (60-72%)  
Calcium hypochlorite (>50%)

**Class 4 –**

Ammonium perchlorate  
Ammonium permanganate  
Hydrogen peroxide (>91%)  
Perchloric acid (>72.5%)

Catalyst compounds come from several hazard classes and usually have descriptive words:

Catalyst

Activator

Accelerator

Curing Agent

Initiator

Hardener

The production of 90% of industrially important chemicals involve catalysts



# Organic Peroxides

An organic peroxide is any organic compound having two oxygen atoms joined together (-O-O-). This is called a “peroxy” group.

The peroxy group is **very unstable** and can easily decompose with an exothermic reaction, and some give off flammable vapors.

Organic peroxides can be severe fire and explosion hazards.

They are often diluted with water or mineral spirits making them more stable to handle. However, when they lose that stabilizing content to evaporation...

Must separate the resin from the catalyst







**Tubes of benzoyl peroxide or methyl ethyl ketone peroxide can range in size from 3 to 10 inches long. They will hide among tubes of adhesives and other PRM materials. Do NOT throw away if opened and dried out! Hazard Class 5.2 Organic Peroxide**







Produces flammable acetylene gas and toxic phosgene gas with water



➤ One of the most common 4.3 materials packed by HHWs, these cans are often passed over during initial sort because they are **quart cans among many PRM cans.**

- It has long been an accepted practice to individually package lithium, NiMH and other high tech batteries individually prior to transport.
- But other “dry-cell” batteries, including alkalines, that are generated in significant amounts were typically bulked without regard for separation.
- Due to numerous transportation incidents the DOT expanded the packing requirement to include batteries not previously affected.
- The Federal Register published January 2009 adopted an amendment that requires all types of batteries to be packaged in accordance with 49CFR 173.159





- Dry batteries, not covered by another entry, must be prepared and packaged in a manner to prevent:

Dangerous evolution of heat from short circuits including - packaging each battery or battery powered device in fully enclosed inner packaging to prevent contact with other batteries, devices or conductive materials (e.g. metal), ensuring exposed terminals are capped.





- Various parties petitioned the DOT regarding alkaline batteries, referring to the results of various tests that showed that these batteries were not likely to generate a dangerous quantity of heat, short circuit or create sparks when **transported in a packaging with no other battery types.**
- The DOT accepted this argument and consequently **spent** alkaline batteries (that make up 80% of total collected for disposal/recycling) are now exempt.

- Terminals should be covered or packaged in such a way that terminals cannot touch.
- Small ziplocks are useful and inexpensive. Hand them out with card explaining dangers when storing and disposing.
- Tape is effective but unwieldy.
- Dipping/spraying in paint or sealant can wear off by the time batteries reach disposal facility. Sealant may have VOCs that can lead to drum fires.







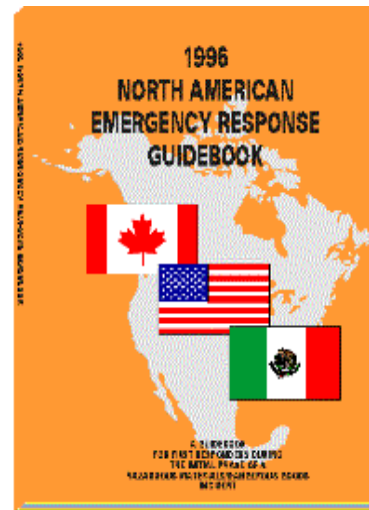
**k1856557 [www.fotosearch.com](http://www.fotosearch.com)**

## Hazard Communication

- In recognition of employee's right to know the hazards of the chemicals that they are or may be exposed to when working, this OSHA standard requires hazard communication in the workplace.
- Hazard communication requires manufacturers and importers to do hazard evaluation prior to marketing products.
- Companies are required to have a written hazard communication program for workers.
- **Employee responsibilities include:** reading & understanding the information given; seeking out information; following instructions; actively minimizing exposure.
- Hazard Communication takes many forms...

## ➤ Information Sources:

- M.S.D.S.
- Placards and Labels
- Shipping Papers
- Reference Guides
- Technical Information Centers
- NFPA 704 System
- Computer Data Bases
- Other (Monitoring results, witnesses, process knowledge, etc.)



Class 1: Explosives, Division 1.1 –1.6



Class 2: Compressed Gases



Class 3: Flammable Liquids (Combustible Liquids)



Class 4: Flam Solids/Self Heating Solids/Water Reactive



Class 5: Oxidizers and Organic Peroxides



Class 6: Toxic Materials



Class 7: Radioactive Material



Class 8: Corrosive Material



Class 9: Miscellaneous

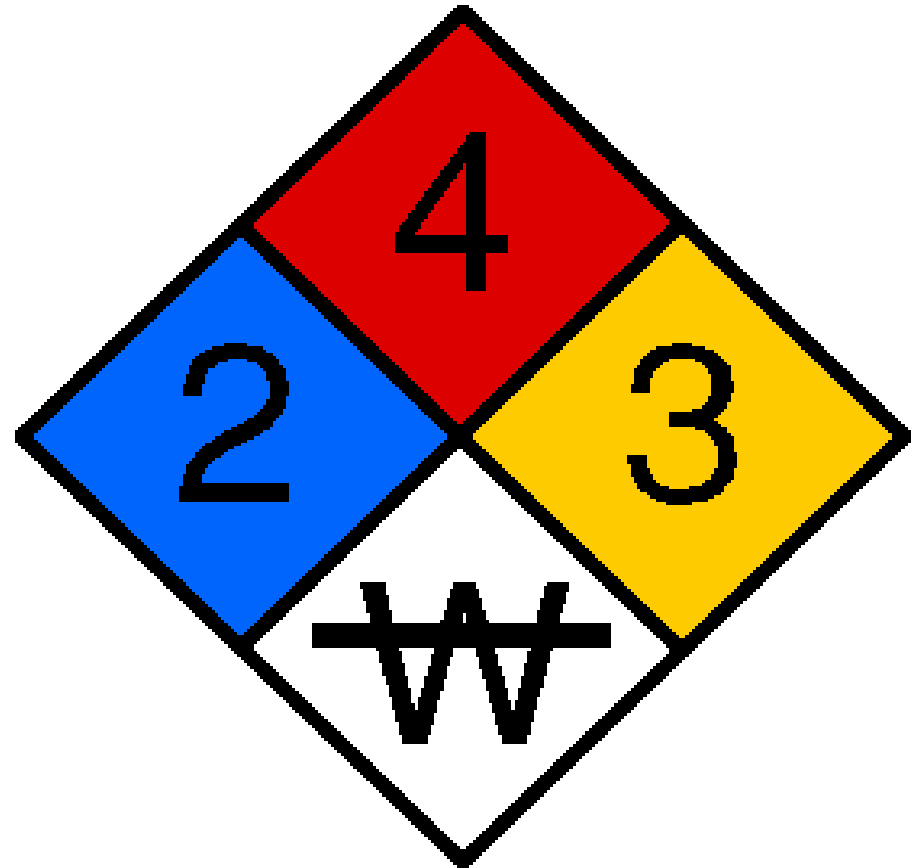
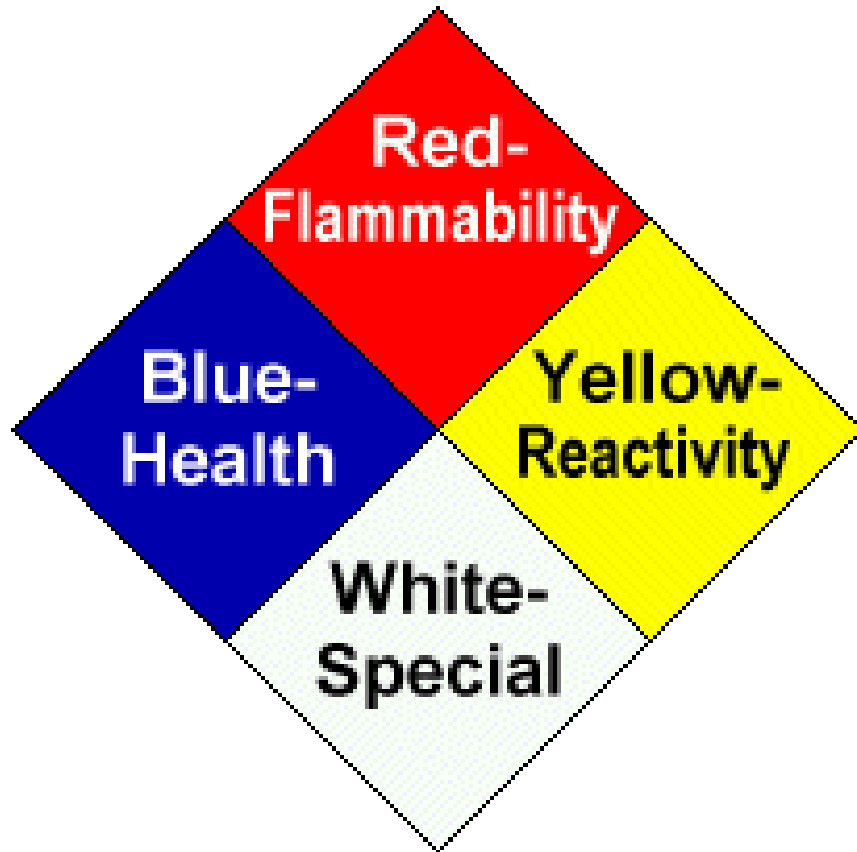


It is possible for chemical materials to have more than one hazard class designation – for example a material that is a pesticide may be a poison (primary hazard) and flammable (secondary) resulting in a designation that would be 6.1 (3). One chemical compound may have up to three hazard class designations.

You can't assume that all hazards of any material are covered by the placard, label or shipping name.

For example a division 2.2 non-flammable, non-poisonous compressed gas is one that does not meet the definition of 2.1 (flammable) or 2.3 (poisonous) compressed gas.





HMIS old

HEALTH			☞	
FLAMMABILITY				
REACTIVITY				
PERSONAL PROTECTION				

HMIS new

CAS# 7647-71-0		
HEALTH		3
FLAMMABILITY		0
PHYSICAL HAZARD		0
PERSONAL PROTECTION		

HMIG

Name of Material	
Hydrochloric Acid 10%	
3	HEALTH
0	FLAMMABILITY
2	REACTIVITY
	PROTECTIVE EQUIPMENT



# Material Safety Data Sheets

- Hazardous Ingredients
- Physical Data
- Company Information
- Fire and Explosion Data
- Health Hazard Data
- Reactivity Data
- Spill & Leak Procedures
- Special Protection Information
- Special Precautions

**MSDS** can vary from one company to another for the same chemical compound. Anything considered proprietary may not be included.

Some MSDS are more useful than others, not all have hazard class or DOT shipping information. MSDS from different years may have conflicting DOT designations.

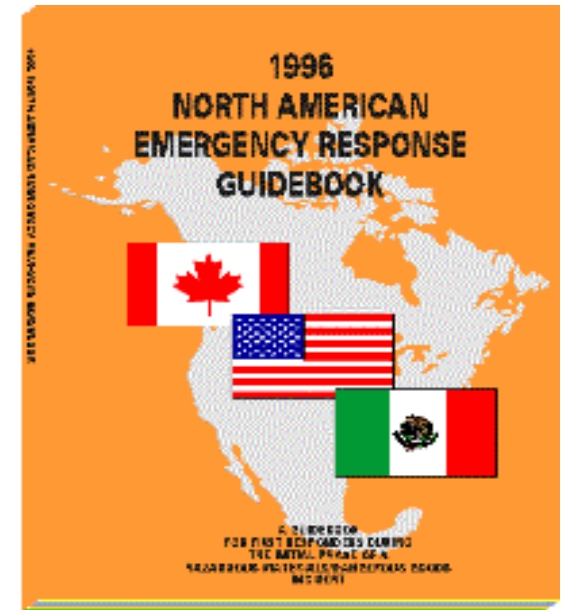
EPA has a list of chemicals that are identified as “Hazardous Substances” under CERCLA. This list is included in the Appendix to DOT’s 172.101 Hazardous Materials Table.

**Appendix A gives the list of Hazardous Substances, and “Reportable Quantity,” or “RQ,” of each chemical.**

Under DOT’s regulations, you must designate a container as “RQ” if you have a quantity of any Hazardous Substance in one container that is greater than the Reportable Quantity.

**HHW materials most likely to “RQ”** are mixed bulk fuel drums (Benzene in gasoline @ 10 lbs); toxics (Diazinon in pesticides @ 1lb); Mercury as liquid @ 1 lb; Calcium Hypochlorite in pool chlorinator @10 lbs.

- Emergency Response Guide Book is a tool to be used during an incident involving hazardous materials. Guide is separated into four color coded sections:
- Yellow – lists hazardous materials by ID # (UN or NA)
- Blue – lists hazardous materials alphabetically
- Orange – guide numbers for Emergency Response information
- Green – initial isolation and protective action distances



- Identify material by finding one of the following :
  - Four digit ID number on a placard or label
  - 4-digit ID # is listed after “UN” or “NA” on package
  - Name of a material on a package
- Look up material’s 3-digit guide (ERG) number using either a yellow index (ID#) or blue name of the material index.

Guide numbers 112 & 114 indicate an explosive hazard class
- Turn to the numbered guide (**orange section**) and read the information.
- Note: if the entry in the **yellow** or **blue** section is highlighted, look up the material in The Table of Isolation and Protective Action Distances (**green** section). You may need to begin protective actions.

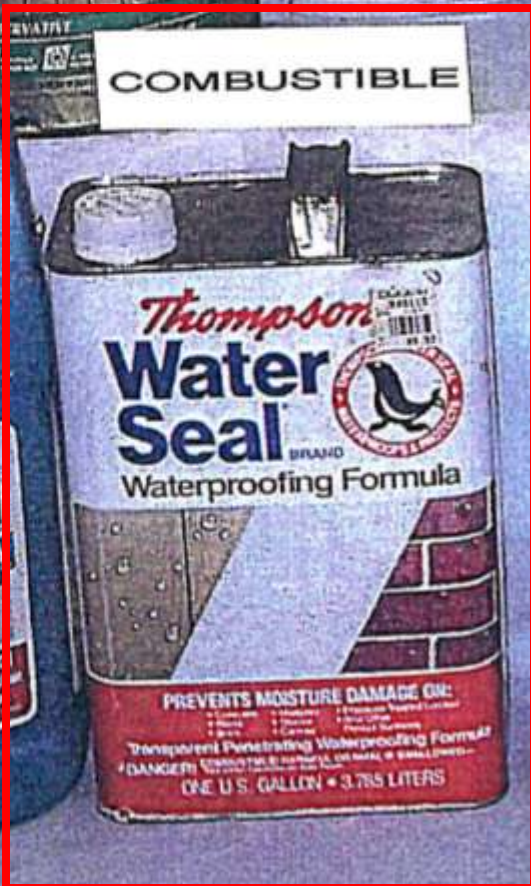
# § 172.101 HAZARDOUS MATERIALS TABLE

(1) Sym- bols  ★	(2) Hazardous materials descrip- tions and proper shipping names  Check 172.101(c), 172.200, 172.202 & 172.203(e)(k)(l)(m)	(3) Hazard class or Division Check 173.2 & 173.2a	(4) Identifi- cation Numbers Check 172.101(e)	(5) PG Check 173.2 & 172.101(b)	(6) Label Codes Check 172. 400 165 & 166	(7) Special provisions Check 172.102 & 172.200 (b) (1)-(5) & 172.506	(8) Packaging (5/73)			Q Label
							Except Solids	Non-bulk	Bulk	
							(5A)	(5B)	(5C)	Pho- to- con- Ch
	Mercaptans, liquid, toxic, flam- mable, n.s.s. or Mercaptan mixtures, liquid, toxic, flam- mable, n.s.s., flash point not less than 23 degrees C. 5-Mercaptotetrazol-1-acetic acid Mercuric arsenate	6.1	UN3071		II 6.1, 3	IM, IM2, T11 TP2, TP13, TP27	153	202	245	
MF	Mercuric chloride	1.4C 6.1	UN0448 UN1623		II 1.4C II 6.1	IB8, IP2, IP4, T3, TP33	None 153	62 212	None 262	
MF	Mercuric nitrate	6.1	UN1624		II 6.1	IB8, IP2, IP4, T3, TP33	153	212	262	
MP, RQ	Mercuric compounds, see Mer- cury compounds, etc.									
MP *	Mercuric potassium cyanide	6.1	UN1625		I 6.1	IB8, IP2, IP4, T3, N73, T3, TP33	None	211		
MP	Mercuric sulfocyanate, see Mer- cury thiocyanate.									
	Mercuric thiocyanate									
	Mercuric azide	Forbidden								
	Mercurous compounds, see Mercury compounds, etc.									
MP, RQ	Mercurous nitrate	6.1	UN1627		II 6.1	IB8, IP2, IP4, T3, TP33	153	212		
RQ A W	Mercury	8	UN2809		III 8			164	164	
MP	Mercury acetate	6.1	UN1629		II 6.1	IB8, IP2, IP4, T3, TP33	153	212		
	Mercury acetylide	Forbidden								
MP	Mercury ammonium chloride	6.1	UN1630		II 6.1	IB8, IP2, IP4, T3, TP33	153	212		
MP	Mercury based pesticides, liquid, flammable, toxic, flash point less than 23 degrees C.	3	UN2778		I 3, 6.1 II 3, 6.1	T14, TP2, TP13, TP27 IB2, T11, TP2, TP13, TP27	None	201		





ALKALINE



COMBUSTIBLE



ALKALINE



OXIDIZER



& AUTO PARTS CLEANER container.

**WARNING:** Do not use on plastic or rubber parts or painted surfaces without pre-testing. This is not a pour-through type carburetor cleaner.

**CAUTION: CONTAINS PETROLEUM DISTILLATES  
AND PERCHLORETHYLENE.**

DO NOT USE NEAR SPARKS, FIRE OR OPEN FLAME. AVOID BREATHING OR PROLONGED CONTACT WITH SKIN. UPON CONTACT WASH FROM SKIN AND EYES IMMEDIATELY WITH COPIOUS AMOUNTS OF FRESH FLOWING WATER. IF SWALLOWED, DO NOT INDUCE VOMITING. CALL PHYSICIAN IMMEDIATELY.

**USE WITH ADEQUATE VENTILATION. KEEP AWAY FROM CHILDREN.**

MANUFACTURED BY  
**RADIATOR SPECIALTY COMPANY**  
CHARLOTTE, NORTH CAROLINA 28234  
WAREHOUSES IN CHICAGO, DALLAS AND LOS ANGELES  
MILWAUKEE, WIS. CO., LTD. MISSISSAUGA, ONT.

- Do not depend on warnings such as “use in a well ventilated area” or “use gloves” to designate a hazard class.
- These warnings are too general and can apply to any chemical.

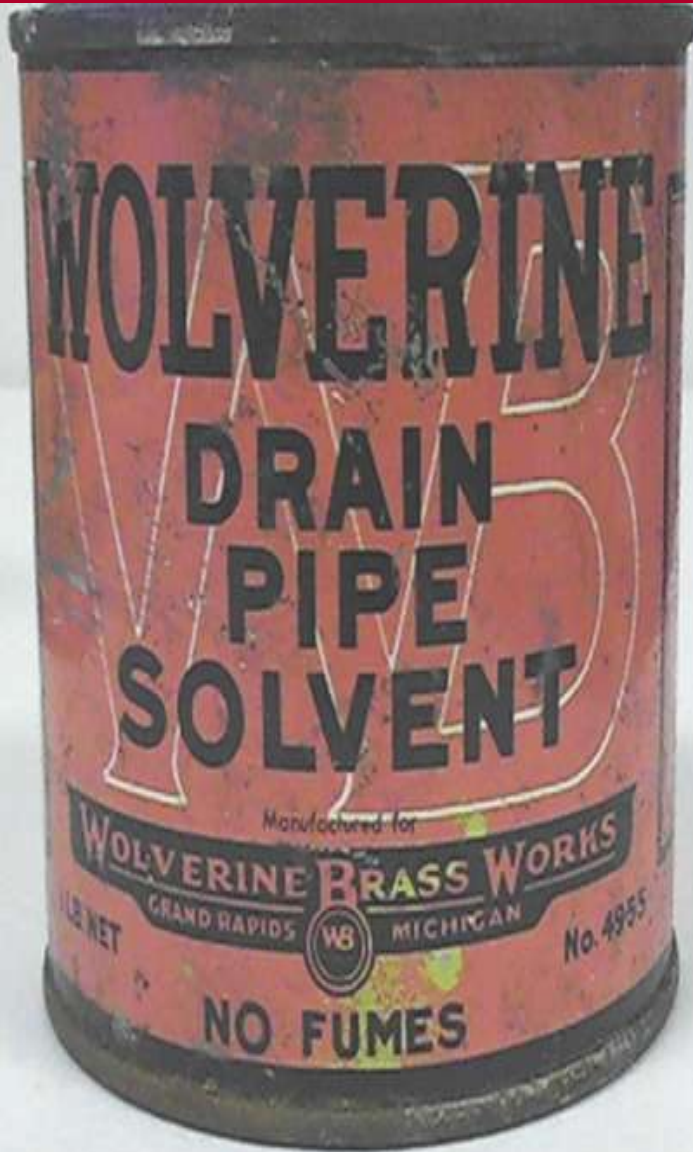
- The following are words that appear on materials from many different hazard classes.
- Do not make segregation or hazard decisions based on these alone.



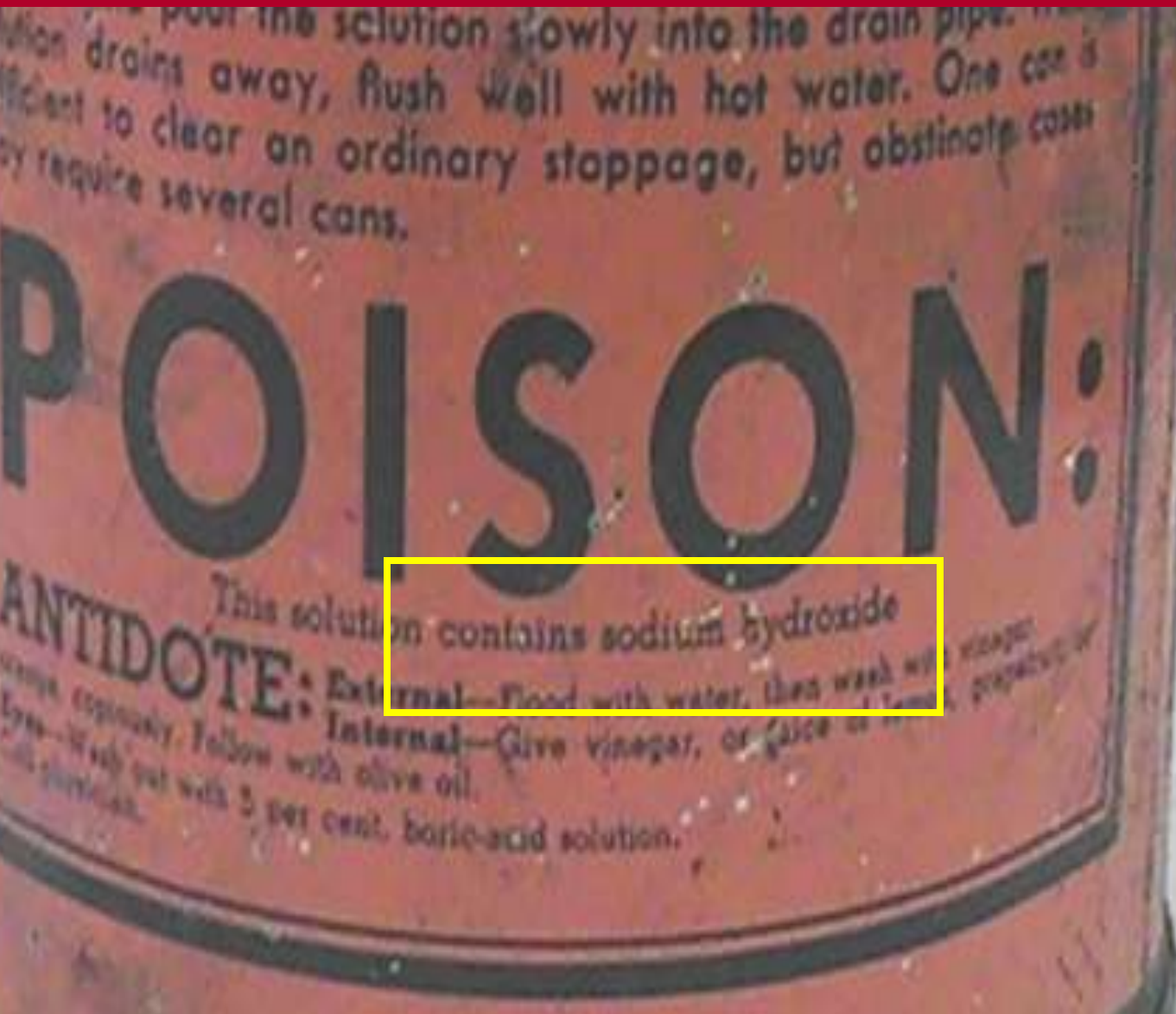
➤ **POISON** – chemical that is toxic in small doses

➤ However the warning **“toxic” or “poison”** may appear on chemical products from almost any hazard class. It is considered to be a practical **warning against ingestion, not a designation of hazard class.**





- **SOLVENT** – chemical or compound that dissolves other materials.
- If your favorite solvent is petroleum based what would you think might be in this container?



And you would  
be wrong.

This is pure  
sodium  
hydroxide,  
a high alkaline,  
corrosive.



- **BIODEGRADABLE** – chemical compound that breaks down into simpler chemical components or elements.
- Does not mean the product has no hazard either for use, compatibility or disposal.

SOLVENT EMULSION  
DEGREASER

**westlode**



**INDUSTRIAL MAINTENANCE DIVISION**  
WEST CHEMICAL PRODUCTS, INC.  
42-16 West Street, Long Island City, New York 11101

**1 U. S. GALLON**

SPECIALLY FORMULATED  
FOR INDUSTRIAL &  
INSTITUTIONAL USE.

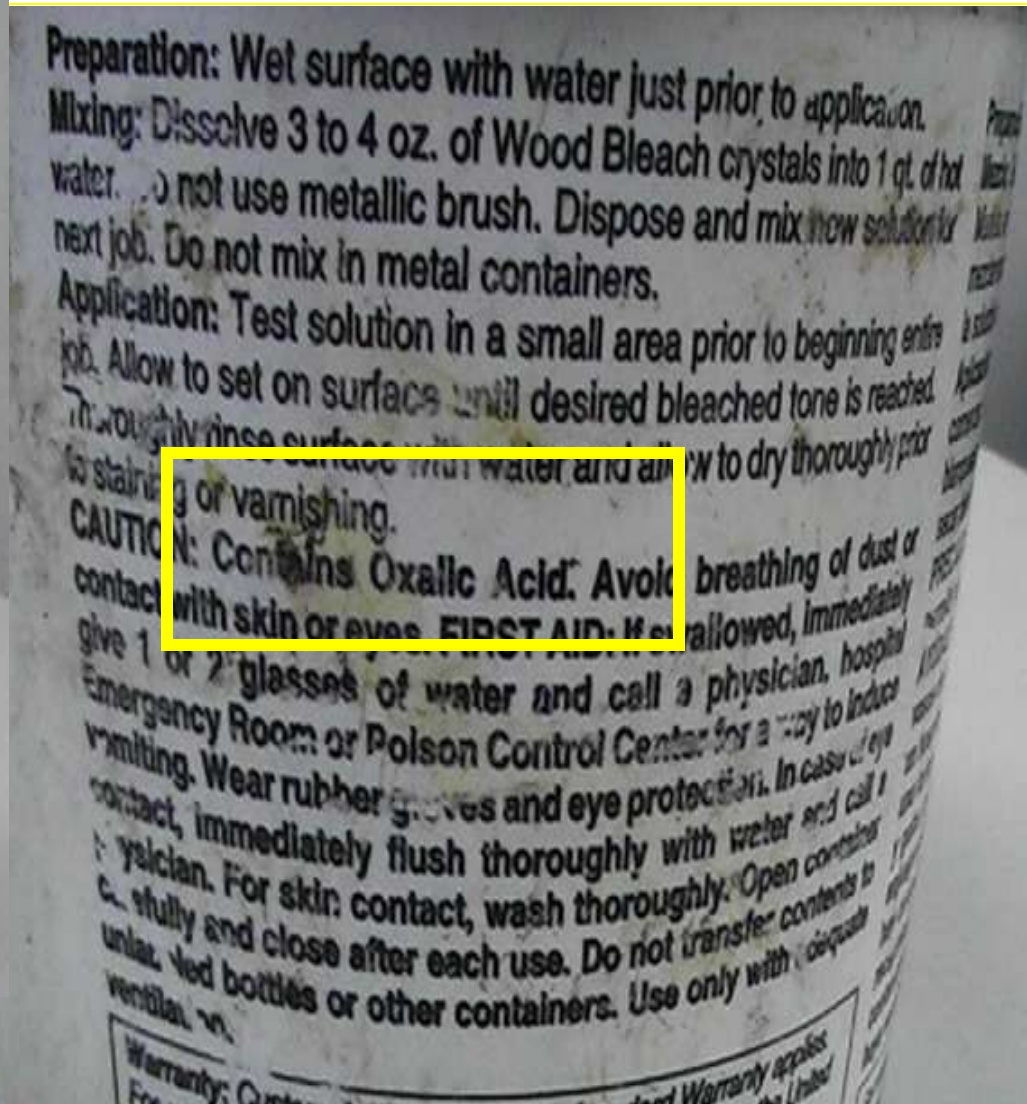
**CAUTION:**

Alkaline Solution

- Do not take internally.  
In case of accidental  
splashing into eyes,  
wash with a copious  
amount of fresh water.  
If irritation persists  
consult physician.
- Avoid prolonged  
contact with the skin.

Before using  
WESTLODE contact  
your local West  
Representative to  
demonstrate the best  
and most economical  
application methods.

- **DEGREASER** – breaks down certain chemical compounds. Your favorite degreaser may be Spic and Span (alkaline), your neighbor may think of Citra Solve (acidic), another may like one based on a chlorinated solvent (carburetor cleaner)





➤ **Does not contain...**

Often a known hazardous chemical is replaced by another material, perhaps of less toxicity. Does not necessarily change the hazard.



ROLL PRESERVE Rewriter  
Rolls, Mimeograph Rolls, Type-  
writer Type, Numbering Ma-  
chines, Addressograph Plates,  
Check Writer Type and other  
Office Devices.

**DIRECTIONS:** Apply Dr. Scat  
with a soft cloth, rub briskly  
on Rubber Platen Roll to re-  
new and refinish. For Type use  
dauber and dry with soft cloth.  
Satisfaction Guaranteed.

**CAUTION:** Contains 1, 1, 1-tri-  
chloroethane, (No carbon tet-  
rachloride.) Use with adequate  
ventilation. Avoid prolonged  
or repeated breathing of va-  
por. Avoid prolonged or re-  
peated contact with skin. Do  
not take internally.





**WARNING:** Tarnite contains Aqua Ammonia, Isopropanol, and Oxalic Acid. DO NOT TAKE INTERNALLY. If swallowed, wash mouth out with water, drink large quantities of milk, and call physician immediately.

**DO NOT GET IN EYES.** If splashed in eye, wash eye thoroughly with water and consult a physician. In case of skin irritation, wash affected area thoroughly with soap and water.

KEEP TARNITE AWAY FROM CHILDREN.

**THE WATER MASTER COMPANY**  
NEW BRUNSWICK, N.J. 08903





Not all quarts are created equal. Small cans constitute a large portion of containers brought to HHWs. Because they are mostly paints and adhesives it is easy to "get on a roll" and toss these containers into PRM drums without paying too much attention to the labels. Look for cans with powder or granular contents, or lids that may hide a small tube or plastic bottle. Reactive materials such as calcium carbide (water reactive, 4.3), hardeners and catalysts from two-part kits (organic peroxides, 5.2) and paraformaldehyde (flammable solid, 4.1) that go through processes such as shred or can crush at the facilities can cause fires, explosions or other unexpected and dangerous reactions. Old wood preservatives may contain large amounts of pentachlorophenol (penta) or copper naphthenate and are labpacked due to toxicity. Not reactivity









Petroleum based products – paints, oil finishes, turpentine, car finish, acetone are PRM.

What types of materials may end up being labpack?

Wood preservatives with listed toxic components, activators, hardeners, catalysts.



Pentachlorophenol – 6.1(3)





**Copper/Zinc Napthenate and Pentachlorophenol in wood preservatives= 6.1(3)**



**What is it?**





## ➤ Carbon Tetrachloride, 6.1 – Phosgene Gas w/ heat



**Isocyanate based foam insulation – catalyst/hardener, contain “non-reactive cyanide” that can react with acids. Aerosol = Poison**

**Drain cleaners come in almost every hazard class!**



**Enzymes**

**citrus oil**

**1,1,1-tri**

**acid**

**alkaline**

**alkaline/oxidizer**

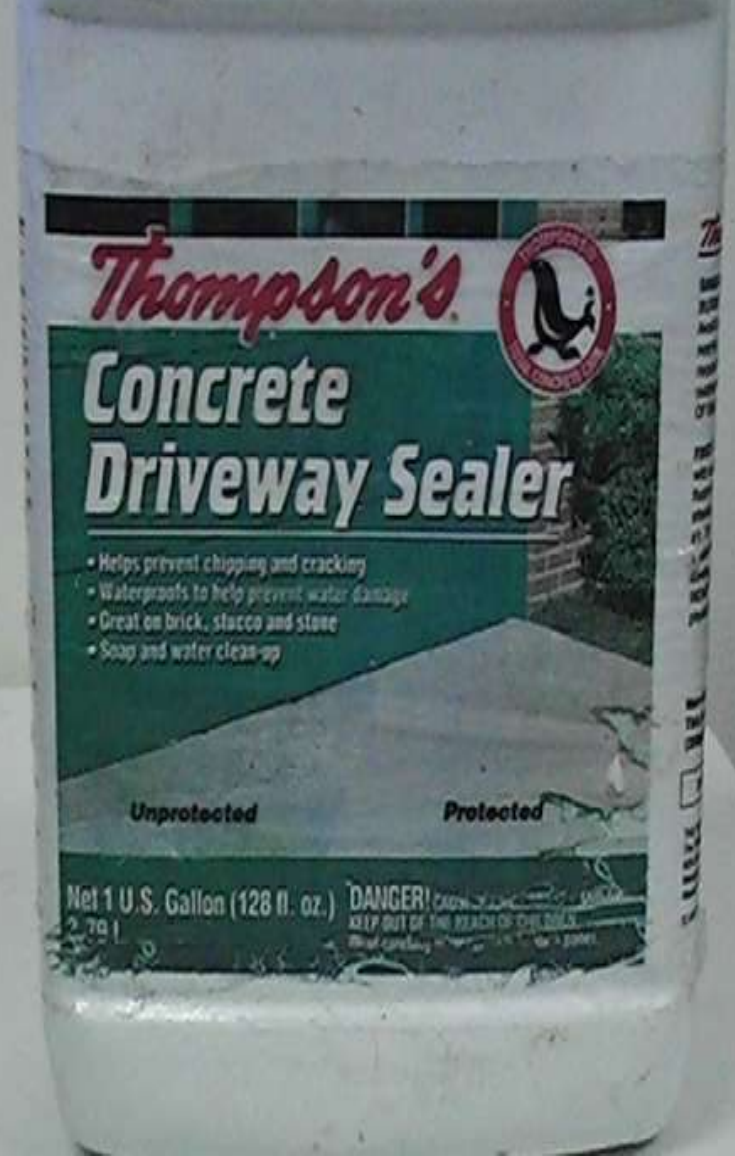




Isocyanurates incompatible with hypochlorites = fire/noxious gas

PRM

Labpack (Potassium Hydroxide)





PRM

Labpack - Alkaline





Old 20 Gal drum of Calcium Carbide. Looks like tan powder and **does not have noticeable water reaction** during HazCat. pH = 14, Oxidizer negative. Must assume that material has water reactive potential and ship as 4.3.





# What's wrong with this Class 9 drum?

Did you say:

- No absorbent visible
- Not packed upright within drum
- Looks like there may be incompatibles
- Open containers with no lids

Let's see what came out...



Y

Net 1 lb

CB 1035

SX 240

# Sodium,

## Reagent, A.C.S., Spheres

Diameter, about 1/16" to 1/4"

### DANGER!

REACTS VIOLENTLY  
WITH WATER  
LIBERATING AND  
IGNITING HYDROGEN  
MAY CAUSE BURNS  
AVOID ANY POSSIBLE  
CONTACT WITH WATER  
AVOID CONTACT  
WITH SKIN,  
EYES, OR CLOTHING  
IN CASE OF FIRE  
SMOTHER

### Maximum Impurities and Specifications

Chloride (Cl)	0.0015%
Heavy Metals (as Pb)	0.0005%
Iron (Fe)	0.001%
Nitrogen (N)	0.003%
Phosphorus (P)	0.0025%
Sulfur (S)	0.005%

7 - CANADA 800-387-9255



38100

1 Lb.

**Manganese Dioxide**  
**Technical Powder**

**cenco**  
.....

CENTRAL SCIENTIFIC COMPANY  
division of Cenco Instruments Corp.  
MADE IN U.S.A.

38620

**SODIUM**  
**NF**

CENTRAL  
division of

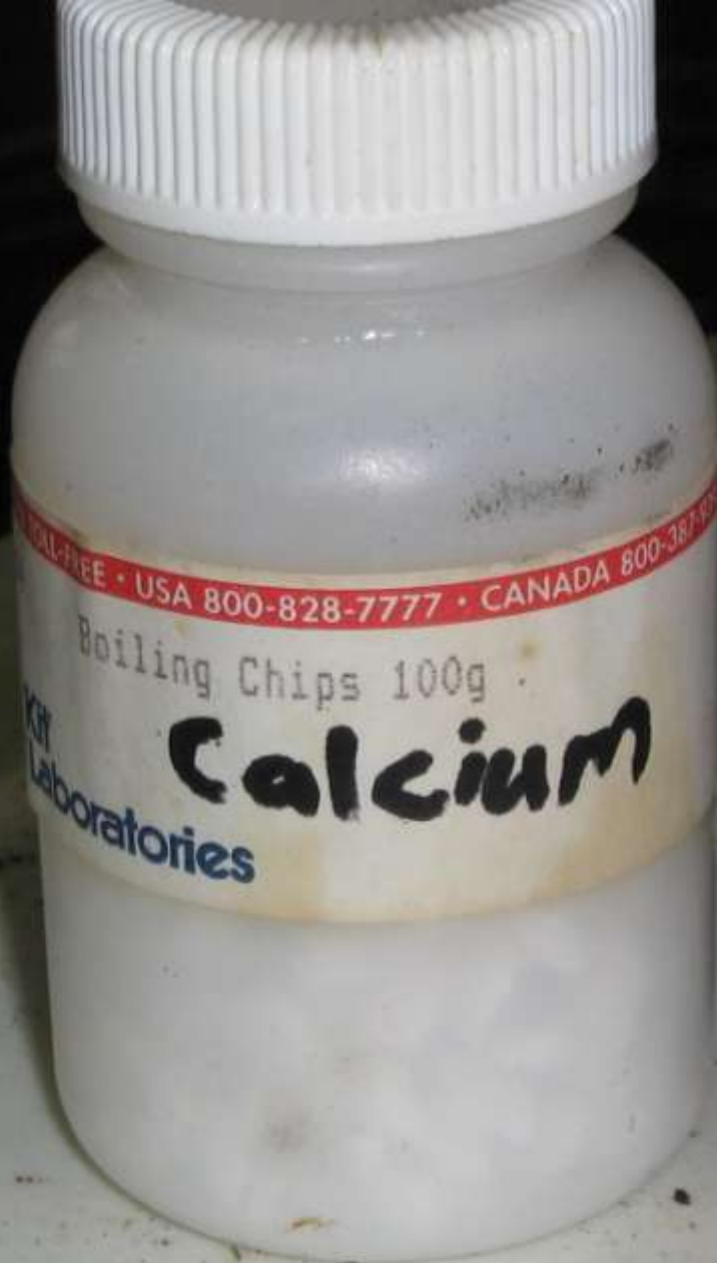
3:1

Cherry





**Plastic containers of MEKP inside.**

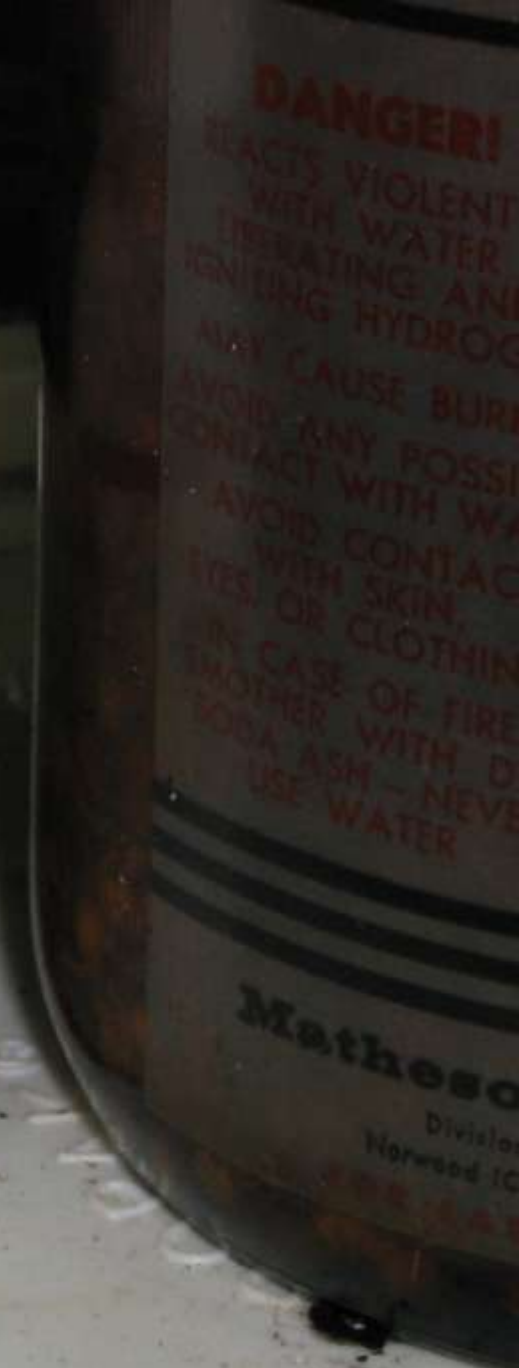


TOLL-FREE • USA 800-828-7777 • CANADA 800-387-8000

Boiling Chips 100g

**Calcium**

Matheson  
Laboratories



**DANGER!**

REACTS VIOLENTLY  
WITH WATER  
LIBERATING AND  
IGNITING HYDROGEN  
GAS  
MAY CAUSE BURNING  
AVOID ANY POSSIBLE  
CONTACT WITH WATER  
AVOID CONTACT  
WITH SKIN,  
EYES, OR CLOTHING  
IN CASE OF FIRE  
SMOTHER WITH DRY  
SODA ASH - NEVER  
USE WATER

**Matheson**  
Division  
Horsehead Industries



# Mercury, elemental



**Richard-Allan Scientific**

# **Uranyl Nitrate Solution**

**Caution: Radioactive Raw Material!**

**16.7 oz / 500 ml**

**Reorder Number 88032**





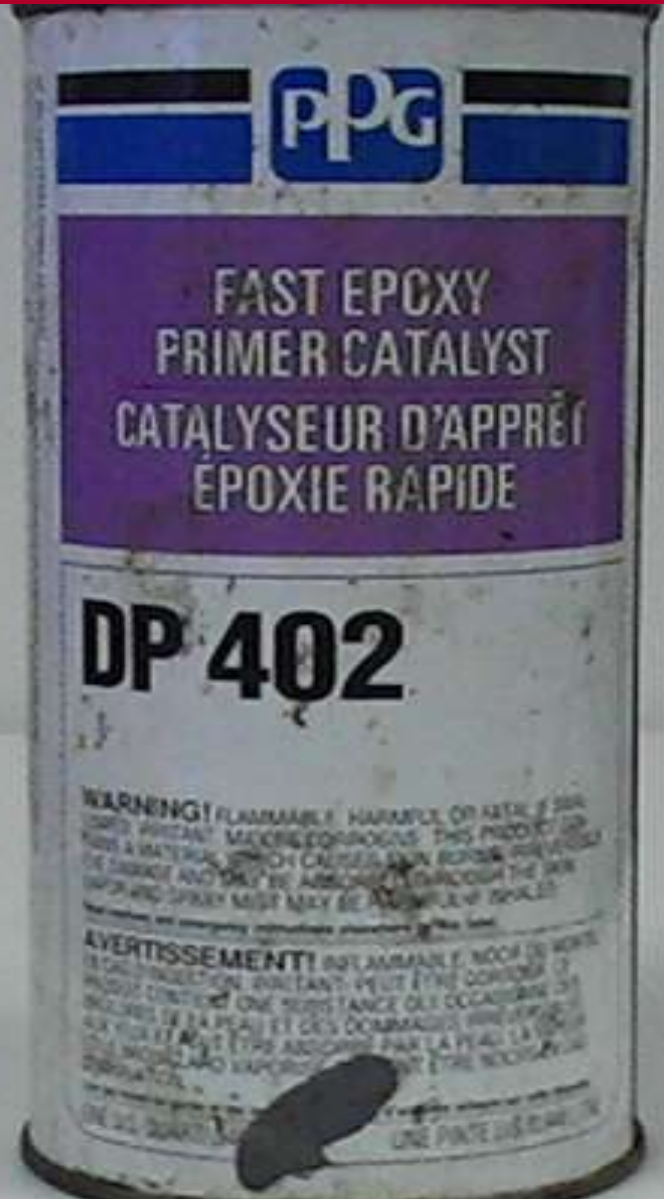
➤ pH w/o water = 13

➤ pH w/ water = 13



➤ pH w/o water = 5

➤ pH w/ water = 2



- pH w/o water = 7
- pH w/ water = 14



➤ pH w/o water = 13

➤ pH w/ water = 13

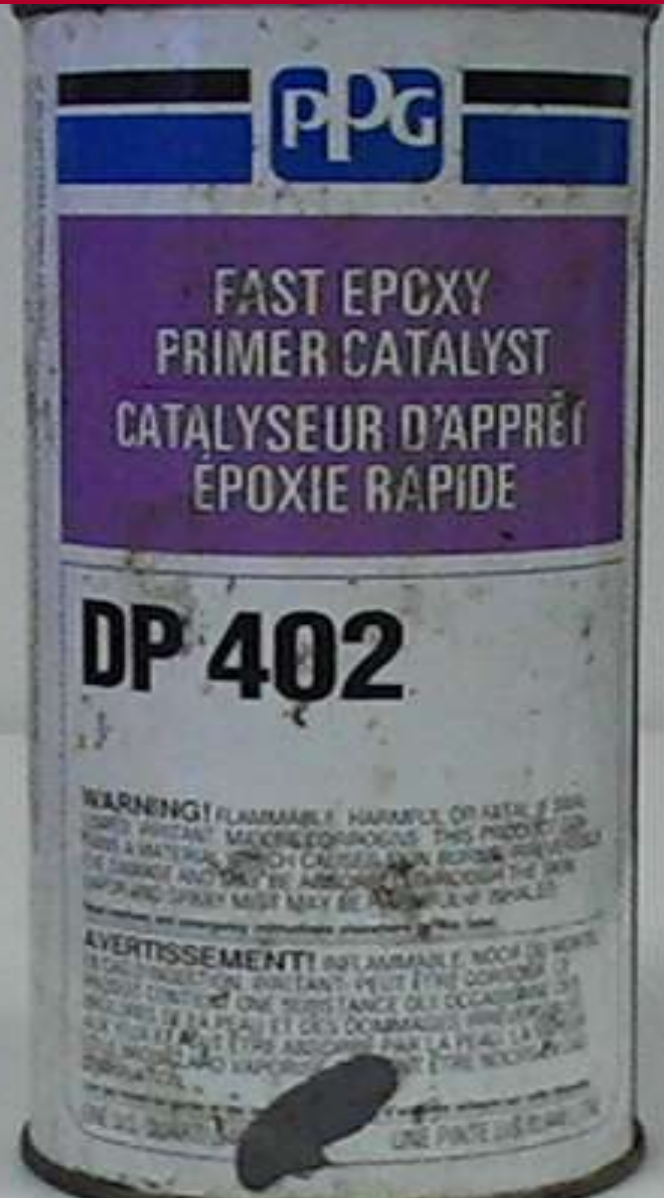
➤ Least amount –

Ph same with and  
without water





- pH w/o water = 5
- pH w/ water = 2
- More alcohol
- pH with water shows some acidity



- pH w/o water = 7
- pH w/ water = 14
- Most alcohol
- pH neutral without water, high alkaline with water

➤ Sodium borate

➤ Sodium **per**borate

➤ Isocyanate

➤ Isocyan**ur**ate

## Case History:

Someone in class had a similar watch that fell to the ground and was run over by a forklift wheel when the wristband became detached.

The owner of the watch put it in his pocket to take home and repair. After about ½ hour he felt like the area around his pocket was warm.

He reached in to pull the watch out and it was **hot**.

That was then he noticed a crack in the casing.

After more investigation he would probably have noticed the button style battery inside was also damaged.





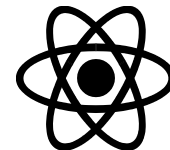


Anhydrous ammonia may be placarded and labeled as a 2.2 non-flammable gas for domestic shipment.

Ammonia has an LEL of 15% and a UEL of 28% - twice the flammable range of gasoline (1.4% - 7.6%)

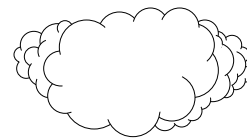
For this reason NIOSH warns that “although anhydrous ammonia does not meet the definition of a Flammable gas (for labeling purposes), it should be treated as one.”

**Made from a single type of atom**



*Examples:*

✦ **Oxygen, Hydrogen, Chlorine**



✦ **Gold, Iron, Sodium**

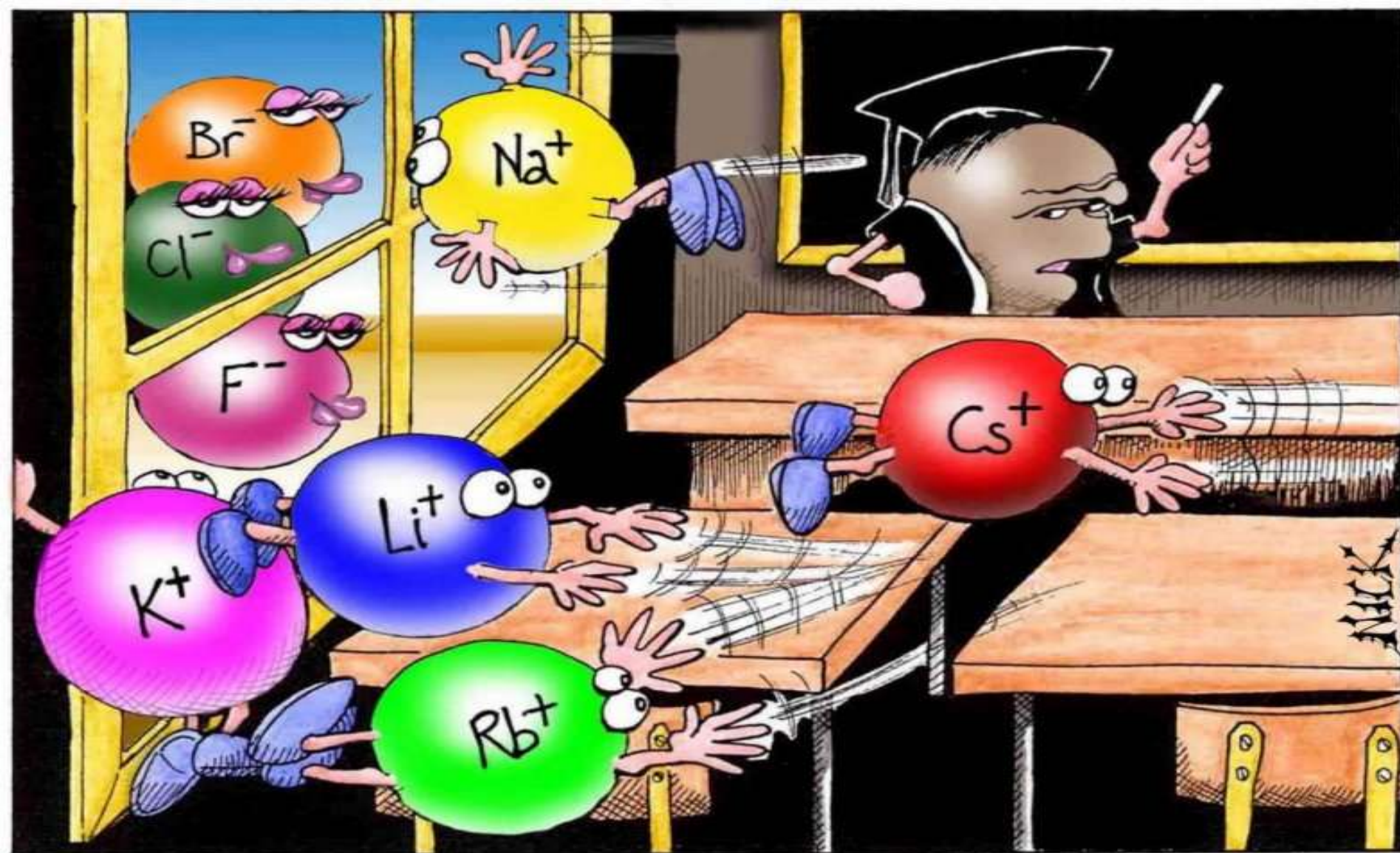


✦ **Carbon, Sulfur, Phosphorus**



✦ **Mercury, Bromine, Cesium**





*“Perhaps one of you gentlemen would mind telling me just what it is outside the window that you find so attractive..?”*



- Sodium Thiosulfate Pentahydrate
- Freezing point 118 F
- Supercooling/supersaturation
- Catalysts – crystals/rusty metal
- Refreezing/solidification creates exothermic reaction, 110 -118 F for 30 mins - two hours
- “Hot Hands” reaches temps of 126-144 F for longer periods can cause 2<sup>nd</sup> degree burns

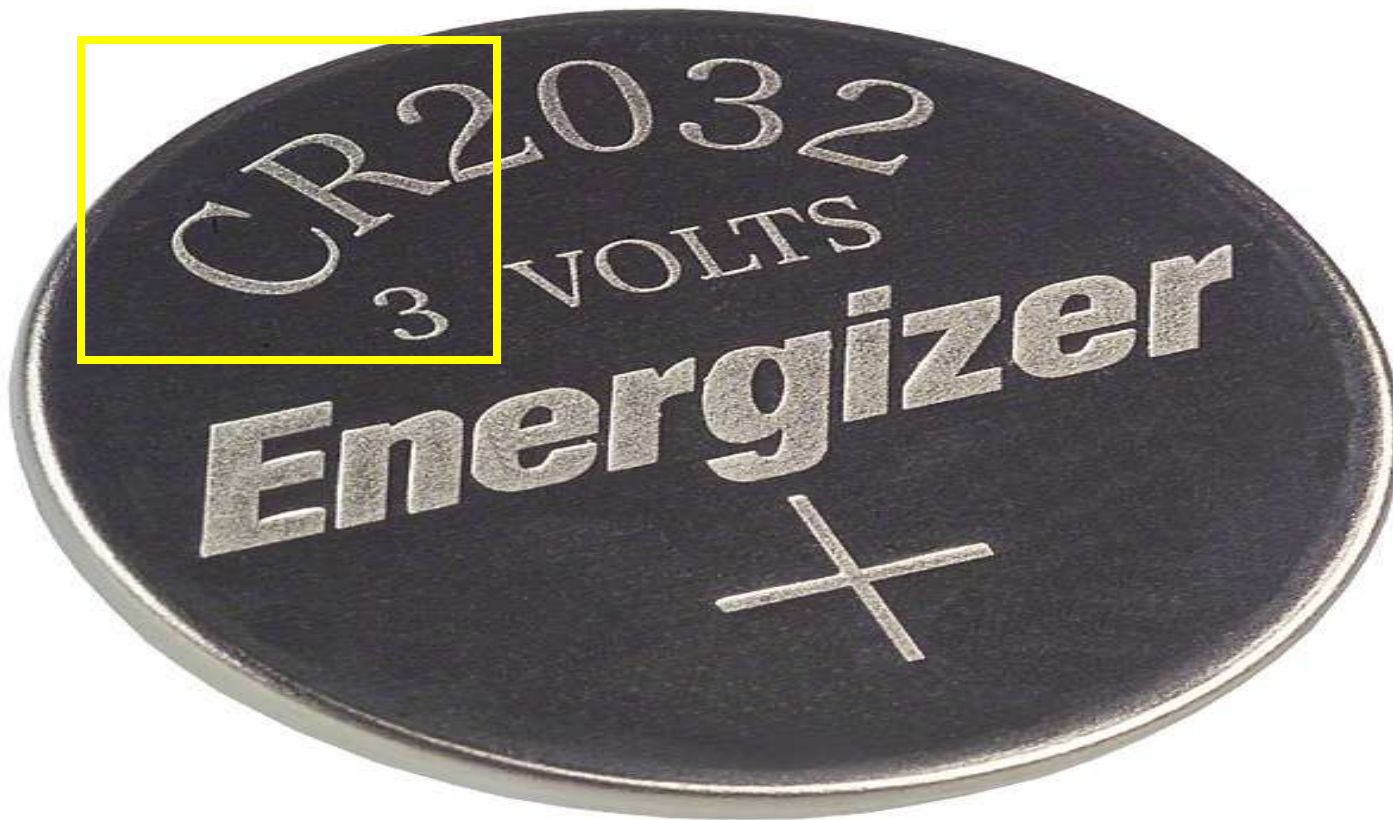


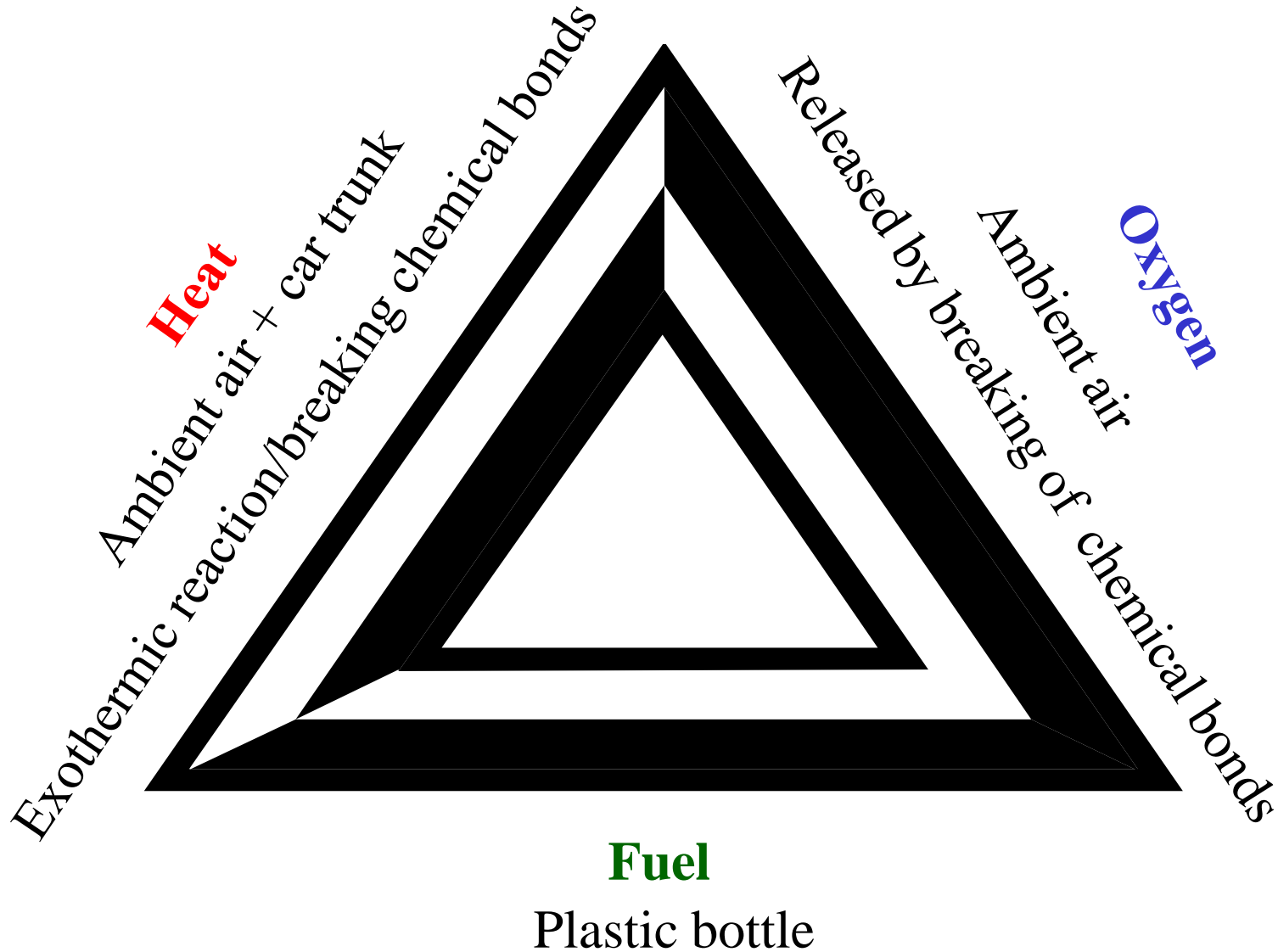
Water = 1

- S.G.>1 material will sink
- S.G.<1 material will float
- S.G. is used to estimate the **weight** of chemical compounds when only their **volume is known**.
- In wastewater treatment it allows for **separation and draining off** of certain materials.
- Specific gravity can help **identify** certain types of chemical compounds in HazCat.
- Specific gravity is also expressed as ***specific density***



- CR type batteries contain perchlorates like lithium perchlorate salts ( $\text{LiClO}_4$ ), as well as lithium metal, manganese dioxide and flammable solvents,





*Elements often join together to  
make **Compounds***

**Element**     $\rightarrow$     **ION**     $\rightarrow$     **Compound**

**+ Positive Ion**  
(cation)

hydrogen or **H<sup>+</sup>**

**- Negative Ion**  
(anion)

chlorine or **Cl<sup>-</sup>**

Put them together and you get:

**HCl** or **Hydrogen Chloride**